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Newsletter for June 2023

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Tail project: status report

By Bleddyn | June 25, 2023

Hello folks! I'm Bleddyn, and I'm team lead with the Tail Project. I'm here to offer some perspective on our recent work, which I was pleased to share with the FFF Discord community a few weeks ago.

First off, introductions: the Tail Project team includes myself, Mecknavorz, and Nalco. Past contributors to the project were Hebi and Luci. We're glad to have help from our Scientific Dergvisory committee, which includes Lathreas, Syralth, and Zennith. *Editor's note: Bleddyn is a dork* :3

If you've read this far, you're probably interested in tails. We are too! The Tail Project aims to create a robotic tail prosthetic that the wearer can move intentionally and intuitively. Rather than relying on puppetry or buttons for control, we feel the ideal tail prosthetic would feel as natural to use as your arms or legs.

Many others have developed versions of this concept over at least the past two decades. Innovative fursuit designers have created passive tails—driven by hip swing or puppetry—with compellingly realistic motion. Academic researchers have designed robotic tails that automatically assist with the wearer's balance (Nabeshima et al., 2019). Others have used a more biologically inspired approach, relying on signals from the wearer's muscles called myoelectricity. While the idea of myoelectric prostheses has been around for decades, the earliest example we've found of

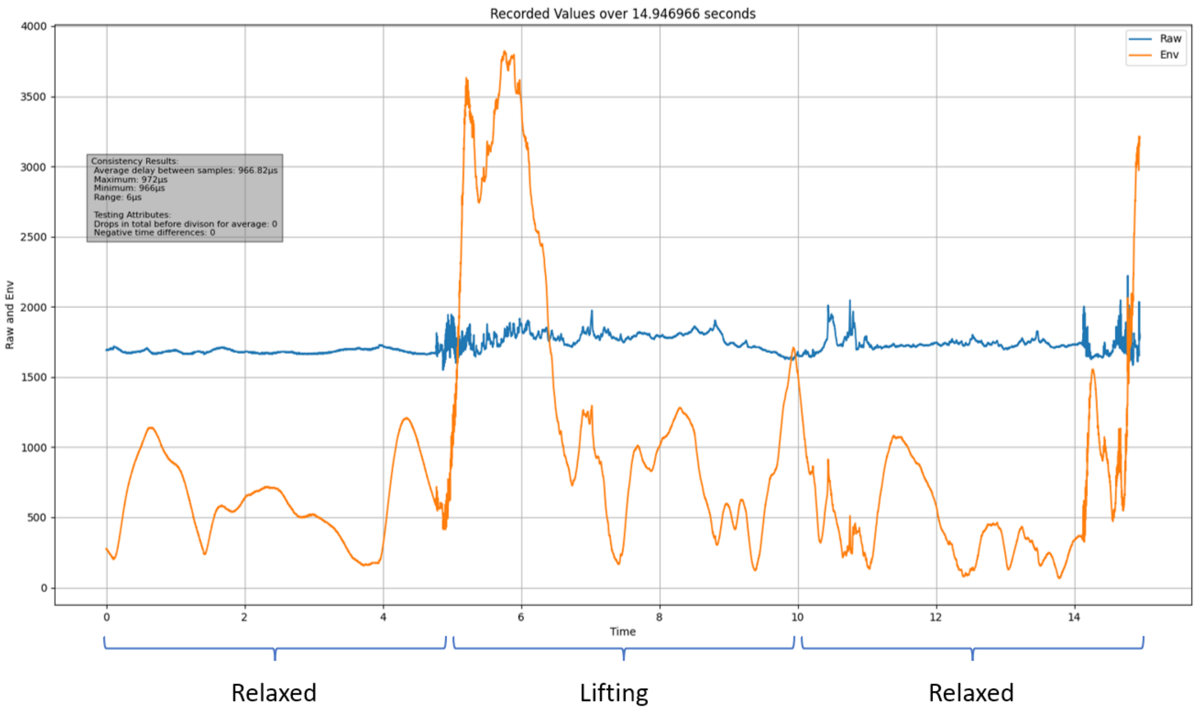


Figure 1: Myoelectric trace of a biceps contraction, as plotted by Meck's plotting software. "Raw" is the output from the EMG amplifier, and "Env" is the envelope signal, which is produced by squaring and low-pass filtering the Raw signal. Inset: summary statistics for sample timing.

this technology applied to tails was posted online around 20 years ago ([Wolftronix, 2003]()).

In the short term, we believe that the best combination of intentional and intuitive control will be achieved by relying on these myoelectric signals. This approach gives us a non-invasive source of control signals that are easy to interpret (relative to, say, brain signals), as well as a large body of prior research that we can draw from in developing our designs. Achieving a tail prosthetic that feels natural to use will be the most challenging and novel aspect of this project. But first, we need to ensure that we can reliably measure a person's intent for tail motion through measuring myoelectric signals, known as electromyography (EMG).

In our last project update, we described our first EMG measurements taken with an off-the-shelf, low-cost EMG system. While we found that we could reliably measure contractions of our biceps muscles, our simple system for data acquisition had a sample rate that was too slow and inconsistent to be useful. Additionally, noise from interfering electrical signals and especially from motion of the electrode cables overwhelmed our measurement system, obscuring the signals of interest. It's important to resolve these issues before trying to measure EMG signals from bodies in motion.

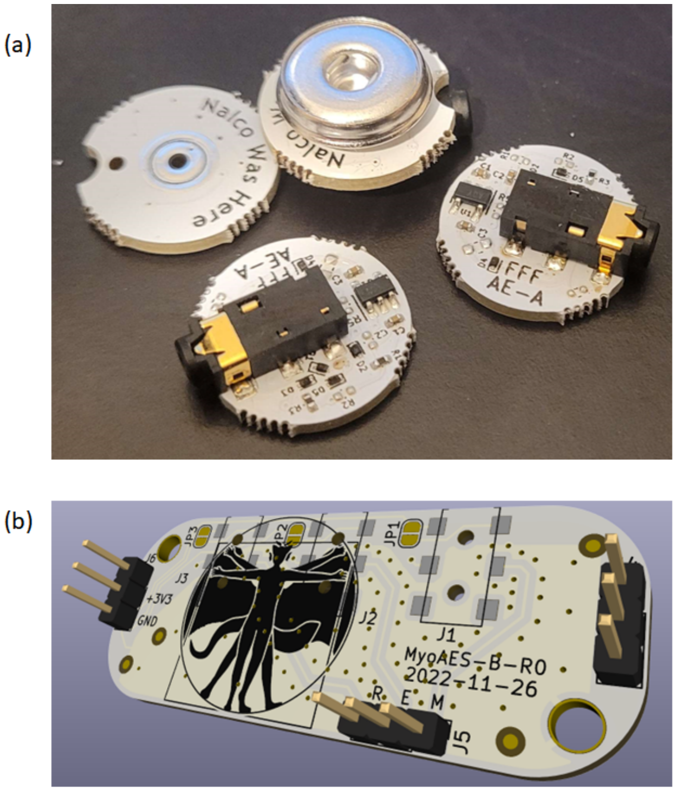


Figure 2: Hardware for our improved electromyography system. (a) Photograph of our active electrodes, designed and assembled by Nalco. (b) Rendering of our active electrode adapter, designed by Bleddyn.

Improvements to the measurement software have been led by Mecknavorz. This task involves two software challenges. First, software running on a microcontroller must acquire signals from the EMG at regular time intervals and transfer these data to a computer via USB. Second, software running on a host computer must receive the data and either record it for later analysis or display it for real-time feedback. So far, Meck has sped up our recording software to a rate of 1024 samples per second—a standard rate for EMG data—with a precision of just six microseconds (Fig. 1)! Meck has also developed a custom algorithm to synchronize data transfers from the microcontroller to the computer. Real-time plotting capability is in the works, and Meck's code is regularly shared on our [github repository]().

Nalco and I collaborated on a solution to our noise and interference problems. Our off-the-shelf EMG system relied on cables to transmit EMG signals from electrodes on the wearer's skin to the EMG amplifier. This left the system vulnerable to noise because of the high gain and high input impedance of the amplifier. As we learned from the EMG literature, one common solution to this type of problem is a so-called active electrode, where a small amplifier circuit is placed on each electrode as close as possible to the wearer's skin. These amplifiers provide a low-impedance path to ground for any interference that couples to the cables.

Our active electrodes were designed primarily by Nalco, based on an open-source design available online. The electrode circuit board is impressively small—only slightly larger than the snap buttons for the stick-on electrodes (Fig. 2(a))! I created an adapter board (Fig. 2(b)) to interface between these new electrodes and our off-the-shelf EMG system, allowing us to avoid replication of these components for now. Nalco has assembled these circuit boards and is testing them to ensure they will perform as designed. We've been comparing our results with a commercial system for measuring electrical signals in the brain.

We've come a long way since our last project update. Though we didn't expect to encounter so many challenges in getting our measurement system off the ground, it's essential to ensure we can get informative and repeatable results for the experiments to come. Once this system is in place, we'll be able to measure myoelectric signals from a selection of muscles in the lower and mid-back. Signals from these muscles, processed through a well-designed algorithm, might allow for intentional and intuitive control of a tail prosthetic.

We'd like to thank FFF staff, volunteers, and the community for their support of our work. The equipment we used to do this research was paid for by FFF donors.

Stories from community moderation

By Zennith | June 29, 2023

Many of our readers already know that we run a Discord server. It's a place for learning, (laid back and informal) intellectual discussion, supporting each other, self-discovery, and having fun.

What does it look like behind the curtain, though? Do we have a shadow council? (Nah!)

Learning…
Personally, I'm constantly learning new things from others on the server. Earlier today, someone posted a video and other information about an Australian patient who had a functioning, medically necessary brain implant, and the implant was removed against her will when the company that had built the implant went bankrupt. That nightmare situation is no longer just a hypothetical. Whoa! (Gilbert et al, 2023). Not what I expected to learn today, but it's an informative cautionary tale about the importance of ensuring any neuroprosthetic devices we develop are open-source and serviceable by at least doctors unencumbered by licenses and whatever other shenanigans that bankrupted company had pulled.

Separately, a couple days ago, I was a fly on the wall (a dragonfly on the wall?) while Coltyn, one of our volunteer scientists and resident eye expert, was talking with a couple community members about ideas of how to modify several properties of the eyes. They discussed pupil shape (including how modified e.g. cat-like slit pupils might change the pattern of how light lands on the retina, implying a need for compensatory modifications of the lens).

The discussion went on to iris color, and a participant mentioned an idea of implanting an artificial, colorful iris under the cornea. It's a neat idea, and one I was personally fond of! But then, Coltyn mentioned that such an implant might interfere with fluid flow in the trabecular network - and blockages can be a risk factor for glaucoma. Good to know!

This sort of exchange of ideas always gets our gears turning. It's impossible to plan or anticipate exactly where discussion will lead. But one thing is for sure: we're exchanging ideas and learning from each other. This ultimately makes it more likely for our whole movement to succeed.

Supporting each other…
There have been a few other recent pleasant discussions which were just *wholesome*.

A recent one that comes to mind is of a server member who was talking about having a moment of self-discovery. This person said she had long-standing feelings for years, but had put up internal, mental barriers and hesitations. That's a feeling I've experienced before - something I'm sure a lot of us share.

But this person, after chatting with folks, being genuine and affirming, sharing experiences about identity and accepting oneself... well, it was heartwarming to see. Longstanding barriers started to fall away, she got more and more excited. Things genuinely clicked for her in a way they never had before.

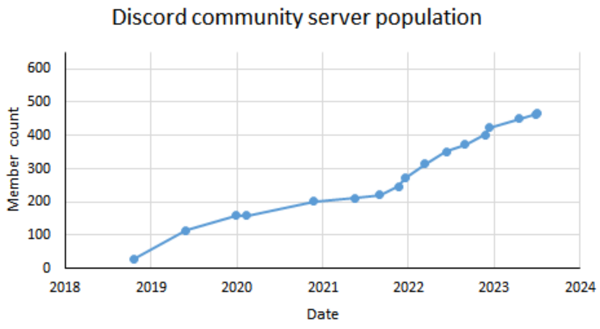
Moments like this make all the hard work worth it. Helping people learn more about themselves, and embracing what makes them unique - I love that every bit as much as I love the science. You folks rock.

Growing...

If you, the reader, can please switch to the logical part of your brain now, it's time for an awkward segue. Thank you!

Our community is active and growing, and has been for quite some time now.

This isn't a race - we don't want to surge to a server of like, 10,000 people overnight. That would be a mess, and defeat the point of a comfortable, accepting community that feels small, even though there's always someone new to talk to.



I just checked on the server population now and added a new point to the graph shown. There are currently 467 members on the server as of this writing! If you had told me we would be here in 2018, I probably wouldn't believe you. It's an amazing feeling to have helped cultivate and environment like what we have.

As is mentioned on our website, we have an interview process to make sure that new prospective server members are a good fit for the community. The moderators work hard to understand each person and see what makes them tick.

We have been getting a lot of new applicants recently - 17 in June alone! It's getting to be a lot to keep track of, but we are committed to spending whatever time it takes to get properly introduced to prospective new members and get them started on the right foot/footpaw.

A couple of our moderators, Hyper and Roo, have stepped forward to help out with the interviews. They've settled into a batch workflow, where about once per week, one of them will take a batch and conduct interviews.

...And getting rid of nonsense

As with any server, there's always going to be ugly bits here and there.

Though perhaps, not as much as you might think!

For the 12 months starting with July 2022 through the end of June 2023, by my count, we've banned 12 people (2 in July, 2022; another 2 that August; 3 last November; a long quiet period without bans; 4 bans in May, 2023 (slight oof), and 1 this month).

Yes, that's 5 full months without *any* bans in a very active server with hundreds of people!

One of the May bans is an interesting story though. The person who was banned had some...interesting views on AI, approaching a superstitious level of AI soon being able to become an AGI and ASI, and that AI would save the world (ignoring the fact that AI doesn't really understand the difference between even and odd numbers).

We had cautioned this server member about not asserting too firmly about the capabilities of AI. They…hadn't really gotten the message, but we weren't sure how to proceed. Their claims weren't in line with a scientific environment, but is it really something we should use moderation tools for?

It turns out, we didn't need to make a decision. A few days later, this server member harassed someone in our community, after having been told very clearly to stop. It was awful, and when I learned the details in confidence from the person on the receiving end, I was furious.

In fact, this was one of the rare bans where we coordinated with another Discord community and discussed specifics with them. After considering relevant factors, we mutually agreed a ban was the appropriate course of action, and we conducted a coordinated ban.

This situation - banning for harassment instead of AI weirdness - has some odd parallels to how Al Capone was caught for tax evasion rather than being a gangster, though obviously less exciting (and thankfully, 100% less deadly!).

To be clear, this situation caused stress for the people involved. But they were fine afterwards, and you just have to look back at how absurd the long tail of moderation incidents can be sometimes!

In conclusion…
To wrap up, there's a lot going on in our community. It's a place for learning, stimulating new thoughts, discovering more about yourself, and supporting each other.

Our community is growing at a relaxed pace, and we're deeply committed to keeping it the sort of environment you can come home to after a busy day and just be yourself. And we are proud to let our banhammers collect as much dust as possible. :3

Thanks for reading!

-Zennith